

Jefferson County Nearshore Restoration Feasibility Report



Prepared for:
Jefferson County Marine Resources Committee

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Figure A. Basic conceptual model of nearshore systems in Jefferson County

Figure B. Conceptual model used to achieve restoration goals

Figure 1. Location map

Figure 2. Oak Bay shoreline change

Figure 3. Oak Bay East oblique air photo

Figure 4. Oak Bay East ground photos

Figure 5. Oak Bay East existing conditions

Figure 6. Oak Bay East proposed conditions

Figure 7. Oak Bay East cross sections (in prep)

Figure 8. Oak Bay West shoreline change

Figure 9. Oak Bay West oblique air photo

Figure 10. Oak Bay West ground photos

Figure 11. Tarboo Bay oblique air photo

Figure 12. Tarboo Bay ground photos

Figure 13. Tarboo Bay existing conditions

Figure 14. Fairmount Marsh area oblique air photo

Figure 15. Fairmount Shore South ground photos

Figure 16. Fairmount Shore South existing conditions

Figure 17. Fairmount Marsh North ground photos

COASTAL GEOLOGIC SERVICES, INC.

INTRODUCTION

This project was initiated by the Jefferson County Marine Resources Committee (MRC) to have analyses completed, and try to move one or several worthy nearshore restoration projects forward toward implementation. The objective of this project was to provide coastal processes assessment and develop specific restoration/soft shore protection design(s) for improving nearshore habitat conditions at one or several sites, and provide conceptual designs at three sites in Eastern Jefferson County.

Four sites were identified by the MRC for this work. The four sites included the parking area at South Indian Island Park, the campground area in Oak Bay County Park, a filled area at an old log-rolling operation on the northeast shore of Tarboo Bay, and the Fairmount marsh pocket estuary in southeast Discovery Bay. During the process, permission for access was denied at a portion of the Fairmount marsh site. This potential project was then scaled back as a smaller potential project was identified located at the south end of the site. General recommended are also provided for the larger Fairmount marsh estuary site.

The purpose of the site visits was to provide feasibility assessments for nearshore restoration. The criteria for restoration feasibility included the presence of a restorable intertidal and upper beach and backshore areas, along with willingness on the part of landowners to participate in the project. Initially the Fairmount marsh site was identified as a primary site, but landowner willingness was not acquired for the entire estuary shore, as explained in the following sections. Detailed design work was completed for one of the sites and included in this report. The selection of the site for design work was based on landowner cooperation and feasibility based on physical processes and erosion processes and trends.

The recommended nearshore restoration actions will need project planning and coordination, and detailed designs will need to be development for the sites other than the primary South Indian Island Park site once funding is acquired.

BACKGROUND

Restoration means the re-establishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics (Cairns 1998, Magnuson et al. 1980; and Lewis 1989 in National Research Council 1992). Restoration typically results in a net increase in the amount, size and/or functions of an ecosystem or components of an ecosystem (Thom et al. 2005). Inherent in current concepts in restoration is that restoration goals cannot typically be achieved without first addressing the controlling ecosystem processes, habitat structure and ecological functions.

In order to maximize the probability of successful restoration, one must develop a clear strategy. Fundamental to any strategic plan, are the identification of clear restoration goals and the development of a conceptual model. A conceptual model can help organize knowledge about how nearshore ecosystems are composed, organized and operate as well as how the system might respond to a particular restoration action (Fresh et al. 2004).

A basic conceptual model, adapted from Thom and Wellman (1996) and Diefenderfer et al. (2006), integrates conditions in the target regions of Jefferson County, MRC restoration objectives and a commonly accepted model used in nearshore restoration (Figure A). This conceptual model can help guide restoration efforts to assure more sustainable, well-functioning nearshore systems, rather than site-specific enhancement. Further, far more detailed conceptual models have been developed by the Puget Sound Nearshore Partnership to guide and predict responses to restoration within Puget Sound nearshore systems (Figure B).

Restoration feasibility is a measure that is commonly comprised several nested values the first of which is property owner willingness. Following that initial filter, feasibility often entails the probability of successfully achieving restoration goals (e. g. ameliorating ecosystem stressors), and the sustainability of the restored condition (e.g. are landscape processes adequately intact to support it?). Achieving restoration objectives and sustainability can be especially difficult to achieve in more urbanized settings due to the inherent constraints of the built environment, the level of landscape alterations from historic (pre-development) conditions and other complexities such as persistent contaminants and invasive species (Simenstad et al 2005).

SITE ANALYSES

General Approach

Background information review, site assessment, planning and coordination were carried out for all sites prior to physical assessments and mapping. This included reviewing published and available unpublished sources of information on coastal processes, erosion/accretion trends, and issues related to feasibility for habitat enhancement at the sites.

The coast of the sites and adjacent coasts were then visited and examined in detail. This included hand excavations, beach sediment characterization, net shore-drift assessment, backshore characterization, and other on-site measurements. The goal of the assessment was to use the knowledge gained to determine whether or not to proceed with design, and if so to evaluate the need for beach erosion management and to design an appropriate soft shore protection/ habitat enhancement project and possibly other shore defense structures. Site visits were made at four sites: South Indian Island Park, Oak Bay County Park, Tarboo Bay, and Fairmount pocket estuary. Jim Johannessen, Licensed Engineering Geologist and MS of Coastal Geologic Services, Inc. (CGS) visited all four sites and Jonathan Waggoner, also of CGS, visited all sites except those at Fairmount.

The South Indian Island Park was selected for development of a draft soft shore protection/ enhancement design (including CAD drawings) to restore habitat functions and minimize coastal erosion. The detailed design included a site topographic survey and specific recommendations for the single site. Conceptual designs were created for the remaining various sites, as landowner permission and feasibility allowed.

South Indian Island Park

Location – South Indian Island Park is located at the southern end of Indian Island at the end of a steep, dirt road off state route 116 (Figure 1). The parking area sits at the base of a well-vegetated, approximately 75 ft high coastal bluff. A gravel parking lot and grass area comprise the uplands of the park. The majority of the park occupies the broad sand flat fronted by a large spit (Figure 2). A salt marsh just east of the park flows through the sand flat and into Oak Bay.

Impaired Conditions – Recent heavy winter storms have caused significant erosion to the waterward edge of the parking area. Matt Tyler, Parks Manager, stated that 8-10 ft of the parking lot was lost to erosion in the previous winter and drift logs were deposited on the access road and parking lot. Jefferson County Parks, in coordination with Randi Thurston of Washington Department of Fish and Wildlife (WDFW) recently reconstructed the rockery landward of its original position (Tyler pers. comm). Public access to the park is threatened by continued erosion of the parking lot. The site is a very important for public access for shellfishing and is also used environment education (Tyler pers. comm). The site does not have shellfishing access for handicapped persons. The Inter Agency for Committee for Outdoor Recreation (IAC) has informed the Parks Manager that this would be an ideal site for handicap access and that funding may be available.

During the May 18 site visit the parking lot and many large (1-2 ft) rocks covered a portion of the intertidal beach (Figure 3). The intertidal at the park provides significant habitat functions and services as evidenced by the extensive use of the area for shellfish harvesting. Sand lance spawning was mapped at this site by WDFW. The beach is also at the mouth of the large, intact saltmarsh complex. The salt marsh drains through a tidal channel that runs immediately waterward of the parking lot at the site. In addition, the west boundary of the site abuts the Port Townsend Ship Canal and the large salt marsh at Oak Bay County Park, where juvenile salmon have been netted numerous times (Hirschi pers. comm.).

Mapping – Historic erosion rates were examined in a GIS using data from USCGS T-sheet no. 1255 from 1871, USGS 7.5' quadrangle maps updated 1973, and LiDAR data collected in 2001 by the Puget Sound LiDAR Consortium. The past shorelines were also compared with data collected during the site survey on May 15, 2007. Erosion rates were measured for three shore-normal transects using the location of Mean High Water as an indicator of shoreline erosion. The central transect (number 2) was centered on the parking area, and the other two were 250 ft to either side along shore (Figure 4). Only the central transect was included in the 2001 to 2007 comparison, as the survey did not encompass the other transects.

Between 1871 and 1973 each of the Transects experienced accretion (Table 1) likely due to construction of the Port Townsend Ship Canal jetty, which traps sediment on its eastern side. From 1973 to 2001 Transect 2 eroded landward 63.9 ft. This represents a rate of 2.3 ft/yr. Between 2001 and 2007 this rate accelerated to 2.7 ft/yr. If erosion continues at that rate it would result in complete loss of the existing parking lot by approximately 2040.

Table 1. Erosion rates along three shore normal transects at South Indian Island Park as measured by the horizontal movement of Mean High Water (MHW). Transects were 250 ft apart centered on the parking lot. Positive values denote accretion and negative values denote erosion.

	1871-1973		1973-2001		2001-2007	
Transect	Erosion (ft)	Erosion rate (ft/yr)	Erosion (ft)	Erosion rate (ft/yr)	Erosion (ft)	Erosion rate (ft/yr)
1	+24.4	+0.24	-92.9	-3.32	nd	nd
2	+41.8	+0.41	-63.9	-2.28	-16.0	-2.67
3	+84.9	+0.83	+67.4	+2.41	nd	nd

Oblique aerial photographs from 1977, 1994, and 2001 were obtained from the Washington State Department of Ecology, and compared for changes at the park (Figure 2). The park was still largely undeveloped in 1977, with only a circular turn-around at the end of the road, and the spit complex had yet to develop to the large size seen today. The 1994 photo shows the parking lot to be roughly what it is today with a rock revetment at its waterward side. The spit waterward of the parking lot had formed by 1994, enclosing and protecting a broad low-tide terrace. The 2001 photo revealed the landward recession of the shoreline at the parking lot. The line of grass seen in 1994 to be in line with the waterward edge of the parking lot, had receded landward in the 2001 photo.

The site was mapped using DGPS and a topographic survey using a high-quality total station with direct rod measurements on May 18, 2007 during a very low tide. An assumed grid was used to perform the survey, which was corrected afterward using DGPS coordinates. Elevation control was based on parking lot elevation in 2001 LiDAR data (Puget Sound LiDAR Consortium). The survey data were reduced in Autodesk Land Development Desktop where a topographic model was combined with GPS measurements to produce a site map (Figure 4). Individual shoreline and park features such as park improvements, rock wall location, waterward extent of driftwood (log line) were all noted and placed onto the map.

The survey shows that the shoreline (measured at the log line) at the park lies landward of the waterward edge of the parking lot. The southwest edge of the parking lot is now on the order of 20 ft waterward of the log line (Figure 5). In addition, the Mean Higher High Water mark (MHHW) was at the base of the recently rebuilt rock revetment, indicating that waves are able to reach the rocks and parking lot daily.

Net shore-drift along this section of shore was mapped by Johannessen (1992) as part of drift cell JEF-2. This cell begins at the southern tip of Marrowstone Island, and continues to the northwest for approximately 2 miles to the east Jetty at Port Townsend Ship Canal.

Proposed restoration – To protect both the current, recreational use of the park and restore intertidal habitat through a simple manage retreat approach. This has been done before at this erosional area, as mentioned above. Specifically, it is recommended that the parking lot be moved landward on the order of 15-30 ft (Figure 6). The parking area should also be raised by approximately 2 ft vertical (to +14 ft MLLW) to prevent storm waves from overtopping the relocated rock revetment (Figure 7). The pit toilet, and possibly the access road, would need to be raised to match the elevation of the proposed parking lot. Some lowering of the grassy area within the footprint of the proposed parking lot would have to occur to provide a flat parking area. The logs that define the parking boundary will be reused for the same purpose in the relocated parking lot, as would the current park information sign.

Reconstruction of the rock revetment will occur coincident with moving the parking area. Some larger armor rock (3 ft rock) should be used in construction to prevent toppling by waves. These new rocks should be carefully placed into a structure typically known as a rockery in order to provide maximum protection from wave energy. The rockery would include smaller rock and high quality geotextile (filter fabric) landward of the armor rock. Detailed design of the rockery is provided in the Figure 7.

Landowner status – The property comprising the uplands of the park is owned by the United States Naval Reserve (USNR) and managed by Jefferson County Parks. At this time it is understood that the USNR is willing to allow modifications to the property for the purpose of nearshore restoration and protection of the park access road and parking lot.

Next steps – Written permission from the USNR will need to be acquired for permitting to begin. Permitting will need to be carried out with Jefferson County (shoreline permit), Washington Department of Fish and Wildlife (WDFW; HPA), and likely also with the US Army Corps of Engineers. However, the Corps may waive the need for a full permit, as the recommended action in the intertidal area (below MHHW) is limited to rock removal.

Oak Bay County Park

Location – Oak Bay County Park is located on the western side of the Port Townsend Ship Canal in northwest Oak Bay at the end of Portage Way (Figure 1). The park consists of a number of grassy camping spots each containing a park bench and fire pit. The entire site sits atop a gravel and sand spit fronting a large marsh complex that historically stretched across the entirety of northern Oak Bay, and closed off the channel between Port Townsend Bay and Oak Bay.

The waterward edge of the road has been armored with a rockery wall comprised of 2-3 ft rock (Figure 8). Approximately 25 ft landward of the park is a salt marsh complex that typically lies less than 50 ft from the camping sites.

Impaired Conditions – Recent heavy winter storms have caused significant erosion to the waterward edge of the park. Storm waves have overtopped the rockery wall, throwing drift logs and gravel onto the road and camping area. Further erosion threatens the recreational use of the park.

The park road and portions of the camping sites were constructed atop intertidal habitat (Figure 9). During the site visit the upper intertidal sediments appeared to be of the type utilized as spawning substrate for forage fish such as sand lance and surf smelt, which typically spawn in the upper intertidal areas (Pentilla 1978). Sand lance spawning was mapped at this site by WDFW. Since the upper intertidal was covered by rock from the rock revetment waterward of the road, this beach likely no longer provides valuable habitat services.

Mapping – Historic conditions were examined in a GIS using data from USCGS T-sheet 1985 from 1871, USGS 7.5 quadrangle maps updated 1973, and LiDAR data collected in 2001 by the Puget Sound LiDAR

Consortium. Erosion rates were measured for three shore-normal transects (Figure 9). The location of Mean High Water (MHW) for each of the above data sources was used to measure changes in the shoreline.

Between 1871 and 1973 the shoreline has eroded landward an average of 1 ft/yr (Table 2). This was likely due to the interaction of a variety of factors. These included construction of the Port Townsend Ship Canal, tidal channel migration, and shoreline development up-drift. In addition, the boat ramp at the park has caused erosion on the northeast (down-drift) side.

Table 2. Erosion rates along three shore normal transects at Oak Bay Park East as measured by the horizontal movement of Mean High Water (MHW). Transects were 250 ft apart centered on the parking lot. Positive values denote accretion and negative values denote erosion.

Transect	1871-1973		1973-2001	
	Erosion (ft)	Erosion rate (ft/yr)	Erosion (ft)	Erosion rate (ft/yr)
1	-18.1	-0.18	-61.9	-2.21
2	-32.2	-0.32	-78.1	-2.79
3	-30.2	-0.30	-72.6	-2.59
4	-75.5	-0.74	-50.0	-1.79
5	-137.6	-1.35	-72.7	-2.60
6	-203.5	-2.00	-12.7	-0.45
7	-182.9	-1.79	-43.5	-1.55
Average	-97.1	-1.0	-55.9	-2.0

The net shore-drift cell in this portion of Oak Bay starts approximately 2 miles north of Olele Point, and proceeds north to the western jetty of Port Townsend Ship Canal, located at the northeast end of the Park site (Johannessen 1992).

Proposed restoration – The ideal restoration approach for this site would be to remove the road, revetment, and severely reduce the footprint of the beach campground. This would allow for beach and forage fish spawning restoration, and would allow the spit to function naturally, with likely landward translation.

A complication of this site is the tidal channel that provides access to the large saltmarsh landward of the spit. This channel had been located adjacent to the east jetty in earlier years, and then was closed for many years prior to circa 2003. At that time, a new channel was formed during a winter storm immediately east of the boat ramp. Although the boat ram was large failed for use as a ramp, the concrete and adjacent rock still acts as a groin in this location. This groin has led to down-drift erosion and the formation of the tidal channel. Therefore removal of the ramp would jeopardize the stability of the inlet and is not recommended without a broader analysis and plan for this valuable salt marsh area.

A more modest enhancement option would entail removal of rock that has fallen onto the beach to restore some intertidal habitat and forage fish spawning area. Rock would be restacked into the voids in the existing revetment. A second option would be to purchase the property on the spit immediately west of park, that is currently for sale, and abandon the easternmost camping sites. These sites reportedly flood many times during the year (Tyler pers. comm).

Landowner status – The park property is owned by Jefferson County. Matt Tyler, the Parks Manager visited the site with the authors of this report and expressed that he expected that the County to be willing to participate in some form of enhancement, and perhaps restoration over time.

Next steps –

Tarboo Bay

Location – The site is located in northeastern Tarboo Bay on the waterward side of Dabob Post Office Rd, approximately 250 ft south of the intersection with Broshear Rd. (Figure 1). This was the location of a log rolling operation, now abandoned in place with remnant rocks and logs on the intertidal. The logs have largely rotted away, but 25 upright logs remained at the time of the site visit (Figure 11).

Impaired Conditions – The upper intertidal area is largely covered by rock rip rap and logs (Figure 12). The rock consists of 2-3 ft pieces buried in the upper beach. Fronting the rock is several 20 in diameter, anchored logs laid out alongshore. In front of the horizontal logs are many closely-spaced logs sunk into the upper beach at a roughly 45 degree slope. These upright logs would have provided a ramp to roll logs into Tarboo Bay for transport to a nearby mill. Landward of the rock, in the area fronted by logs, was scattered smaller (12 in) rock

The area waterward of the rock and logs did not contain any intertidal vegetation, although thick beds of saltmarsh vegetation were seen immediately north and south during the site visit (Figures 12 and 13). It is likely that this is due to the presence of shoreline armoring. The logs appeared to be treated with creosote, and therefore present an additional burden to the surrounding ecosystem beyond that of physical armoring.

Landward of the rock and logs was an approximately 4 ft high bank comprised of compacted fill. Evidence of recent erosion was sign during the site visit (Figure 12). Atop the fill was a 2-3 in thick roadbed comprised of shell debris. The fill was likely deposited atop existing intertidal habitat during placement of the rock and logs.

Mapping – Shoreline features at the site were mapped using DGPS. These features were all digitized and imported in a GIS for analysis (Figure 13). The line of rock was mapped as extending 350 ft alongshore, covering approximately 1,050 ft² of intertidal habitat. More habitat was covered by the smaller rip rap landward of the line of rock, but was not measured during the site visit. The remaining logs were in the central and northern portion of the site and cov a substantial amount of beach area.

A typical cross section was drawn from measurements made on site (Figure 13). Above and below the area of rock and logs the beach slope was found to be approximately 10:1 (H:V). Where the rock and logs were located the slope was approximately 6:1 (H:V).

Proposed restoration – Removal of logs and rock form the intertidal is the top priority at this site. Given the presence of creosote, special care must be taken in their removal to ensure proper containment and disposal offsite. An excavator with sufficient reach to remove the logs would be useful for removal, with a dump truck for transport off site. The horizontal logs appeared to be attached to an unknown anchor by ½ inch cable. These anchors should also be removed from the site.

After removal of rock and logs from the intertidal a moderate quantity of fill should be removed from the parking area to lower the slope, provide recreated intertidal and backshore area, and public better access as well as a transitional ecotone. Providing a 10:1 slope through the fill would require complete removal of the parking area. This may not be acceptable for the local users of the site. In order to provide increased habitat and preserve the current use of the property a slope bet 6:1 and 8:1 would provide habitat benefits. This would require removal of an approximately 25-35 ft wide stretch of the waterward side of the parking area. The upper portions of the slope should be planted with native dunegrass (*Elymus mollis*) to provide stability and additional habitat.

Removal of non-natives such as Himalayan blackberry should also occur during restoration activities. Areas of removed vegetation will need to be planted with native species and maintained to ensure survival of planted species.

Landowner status – The property between the road right-of-way and MHW is owned by Michael Olson, and is contiguous with the property landward of the Dabob Post Office Rd. right-of-way. During the site

visit he stated that the site is frequently used as a pull out and observation point, and expressed concerns that the restoration may impact current use. Public access must be maintained in order to secure permission for restoration activities at this site.

Parcel data obtained from the Jefferson County Assessor (2007) shows a portion of the parking area and upper intertidal is contiguous with the parcel across Dabob Post Office Rd. Washington Department of Natural Resources (DNR) owns the land waterward of Mean High Water (MHW), +10.53 ft MLLW at the National Oceanic and Atmospheric Association (NOAA) tidal benchmark at Quilcene. At the location of cross section A-A' this is the landward edge of the riprap. Given the focus on restoration DNR is expected to permit restoration activities at the site.

Next steps – The most important step for this site will be to gradually work with the landowner and neighbors on the value of nearshore habitats and the opportunities for restoration at this site (and possibly others in the area). The site will need to be surveyed to determine the exact location of property lines as well as topography for engineering design. Landowner permission will need to be formally secured during this phase in order to continue to the permitting phase.

Fairmount South Shore

THIS ONE AWAITED FINAL CONFIRMATION OF LANDOWNER WILLINGNESS, and will be completed next.

Location –

Problem –

Mapping –

Table 1. Potential rock removal area from upper beach at Fairmount South Shore by shore segment (Figure 16).

Shore Segment	Length (ft)	Width (ft)	Area (ft ²)	Description
a	33	5	165	tight, large & small rock, stacked
b	59	4	236	tight, large & small rock, stacked
c	16	3	48	tight, large & small rock, stacked
d	29	4	116	scattered, large & small rock, stacked
e	15	5.5	82.5	large, tight rock
f	8	2	16	scattered rock
g	4	3	12	scattered rock
Total	164		675.5	

Proposed restoration –

Landowner status –

Next steps –

Fairmount Pocket Estuary

THIS ONE AWAITED FINAL CONFIRMATION OF LANDOWNER WILLINGNESS, and will be completed next.

Location – southern Discovery Bay, near the end of Fairmount Drive (Figure 1).

Problem – Natural spit covered by construction of a now-abandoned rail line. Saltmarsh impounded by construction of causeway.

Mapping – Site visit

Proposed restoration – Reopen the saltmarsh to tidal flushing and restore intertidal habitat on the spit through removal of the railroad causeway.

Landowner status – Multiple landowners surround the saltmarsh. Not all owners are willing to have depart from the status quo.

Next steps – ??

Limitations of This Report

This report was prepared for the specific conditions present at the subject property to meet the needs of specific individuals. No one other than the client should apply this report for any purposes other than that originally contemplated without first conferring with the geologist who prepared this report. The findings and recommendations presented in this report were reached based on a brief field visit. The report does not reflect detailed examination of sub-surface conditions present at the site, or drainage system designs, which are not known to exist. It is based on examination of surface features, bank exposures, soils characteristics, beach features, and geologic processes. In addition, conditions may change at the site due to human influences, floods, earthquakes, groundwater regime changes, or other factors. This report may not be all that is required by a construction or drainage contractor or revegetation specialist to carry out recommended actions. Drainage recommendations provided here are intended to be at a general level. More detailed design specifications may be needed for proper implementation of a drainage system. Great care must be exercised when working on unstable slopes or close to foundations.

Thank you for engaging the professional services of Coastal Geologic Services, Inc. If we can be of any additional assistance please contact our office.

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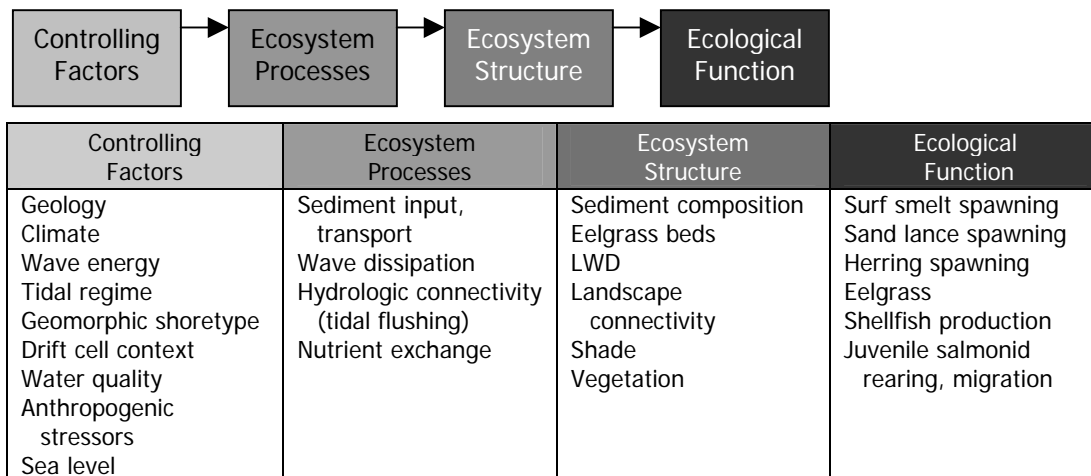


Figure A. Basic conceptual model of nearshore systems in Jefferson County.

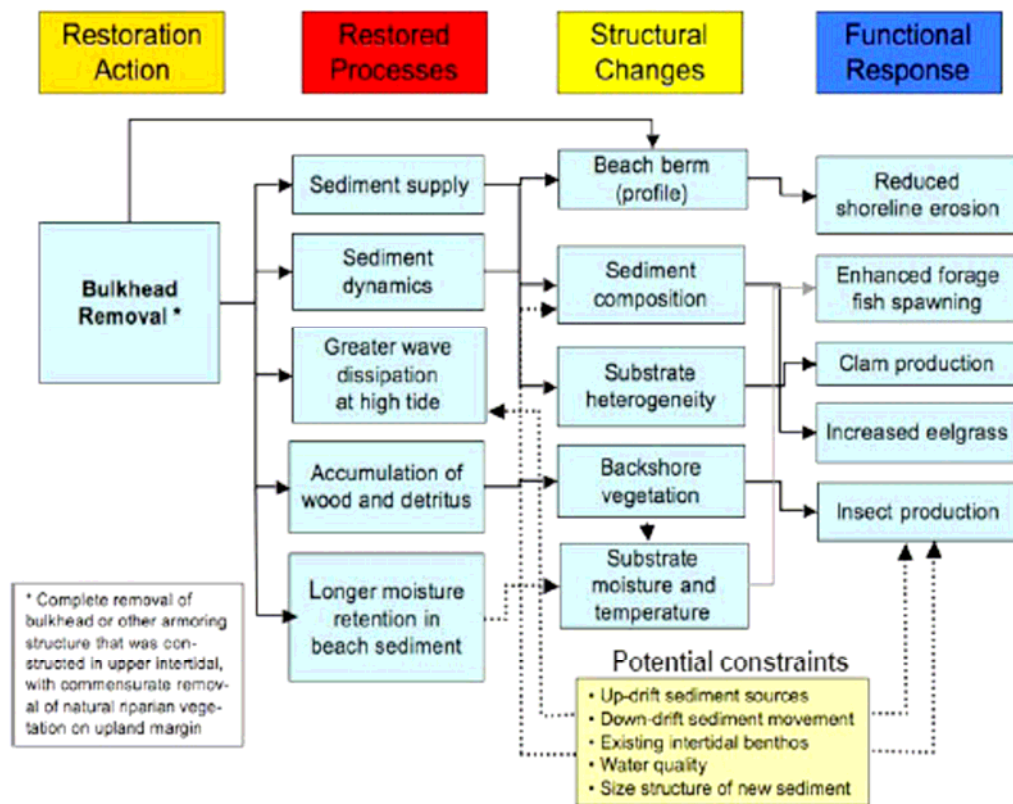


Figure B. Demonstrates how conceptual models can be used to achieve restoration goals (Simenstad et al. 2006.)

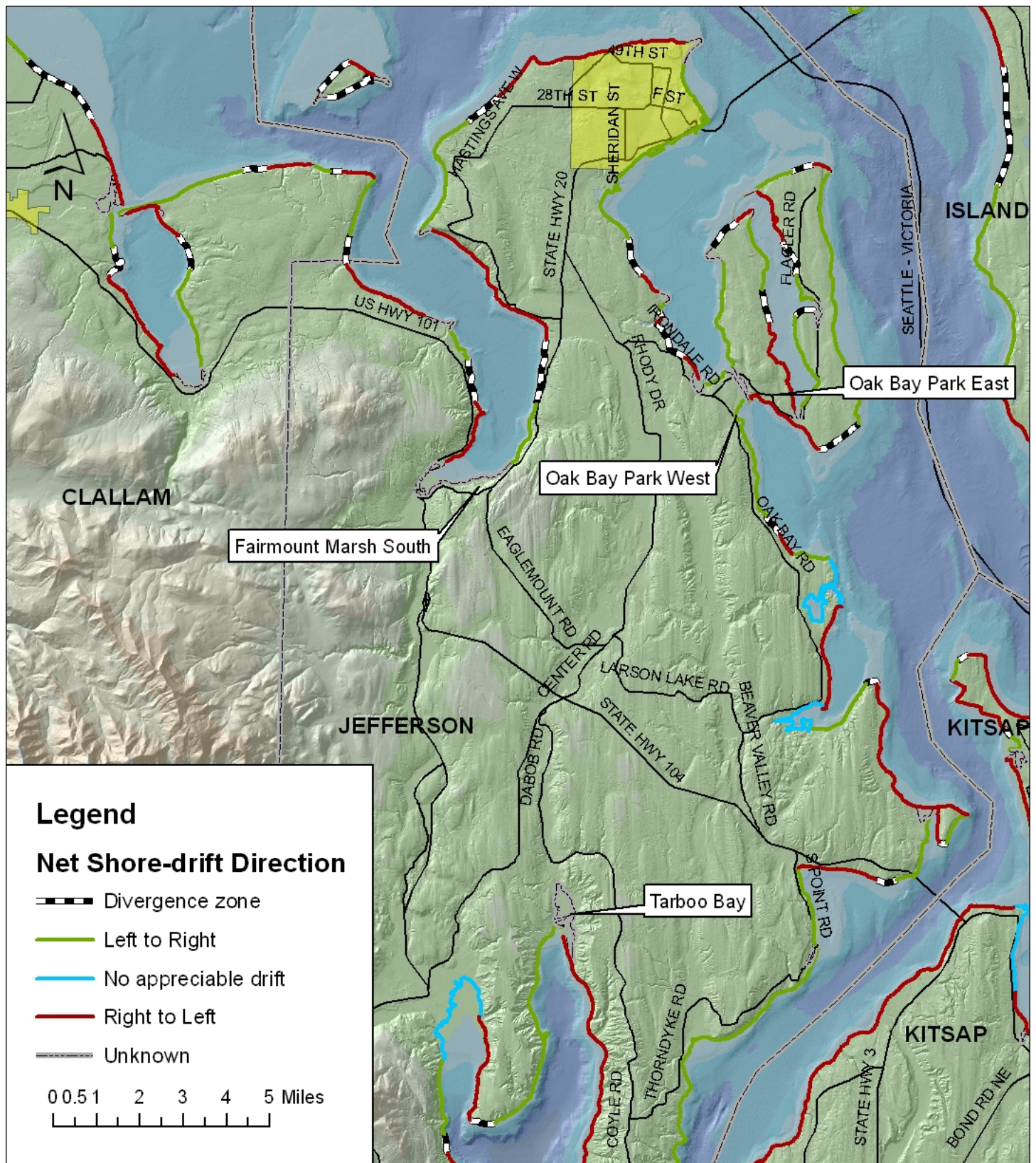


Figure 1. Jefferson County nearshore restoration feasibility sites and vicinity

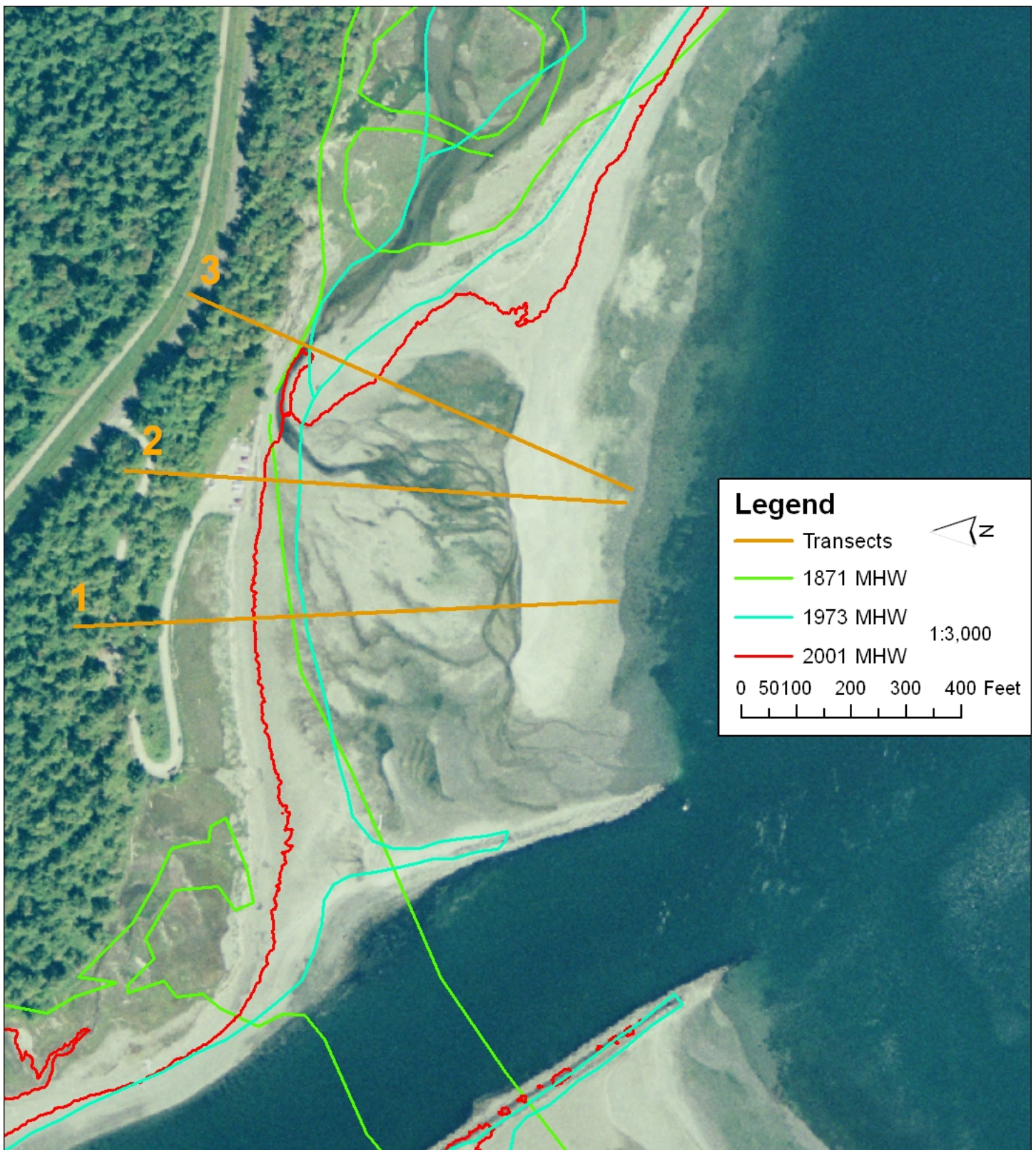


Figure 2. Oak Bay Park East historic shoreline change mapping



Figure 3. Oak Bay East oblique aerial photographs from 1977 (top), 1994 (middle), and 2001 (bottom). Note landward retreat of driftlog zone between 1994 and 2001.



Figure 4. Oak Bay East ground photos taken May 18, 2007.

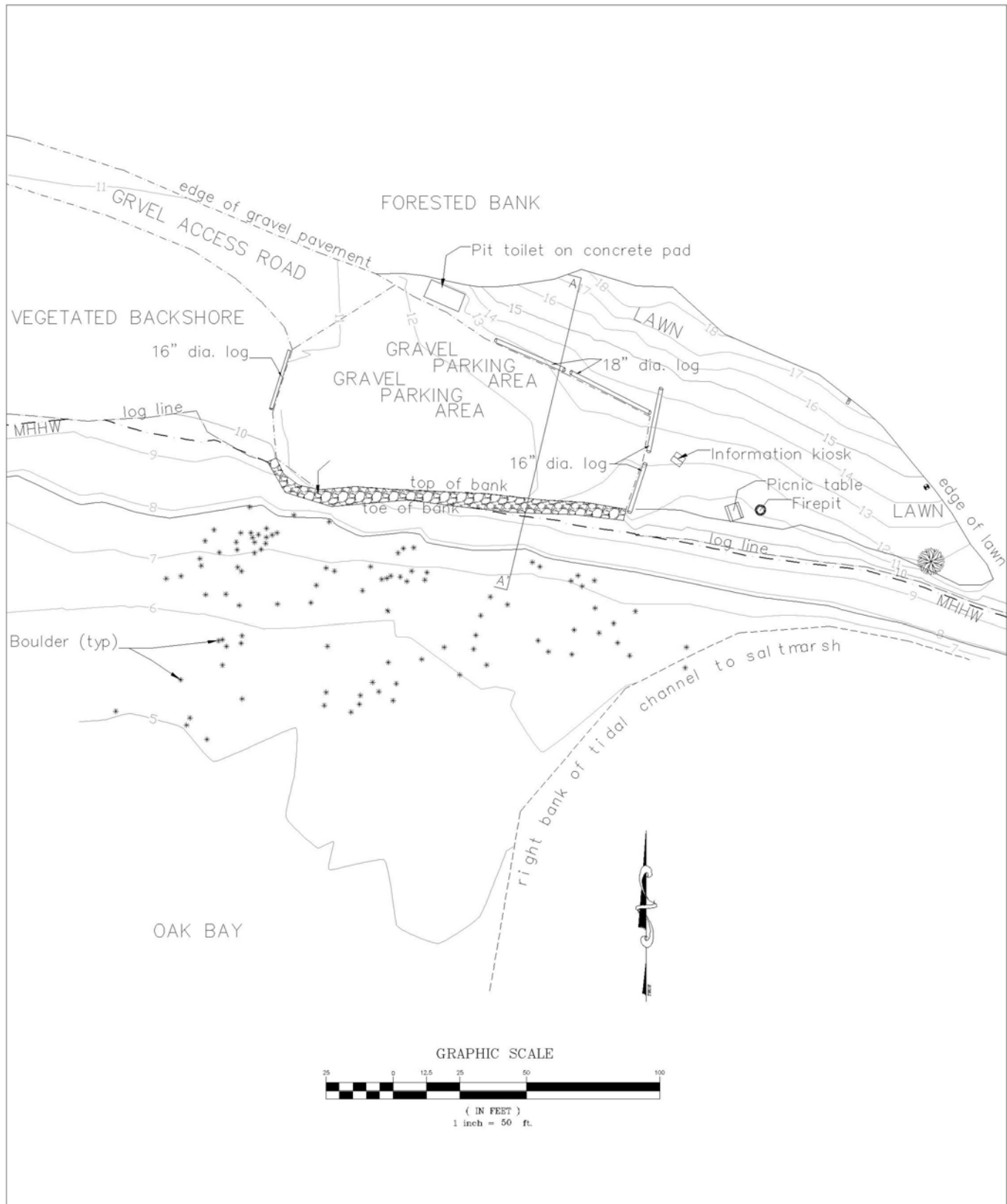


Figure 5. Oak Bay East existing conditions

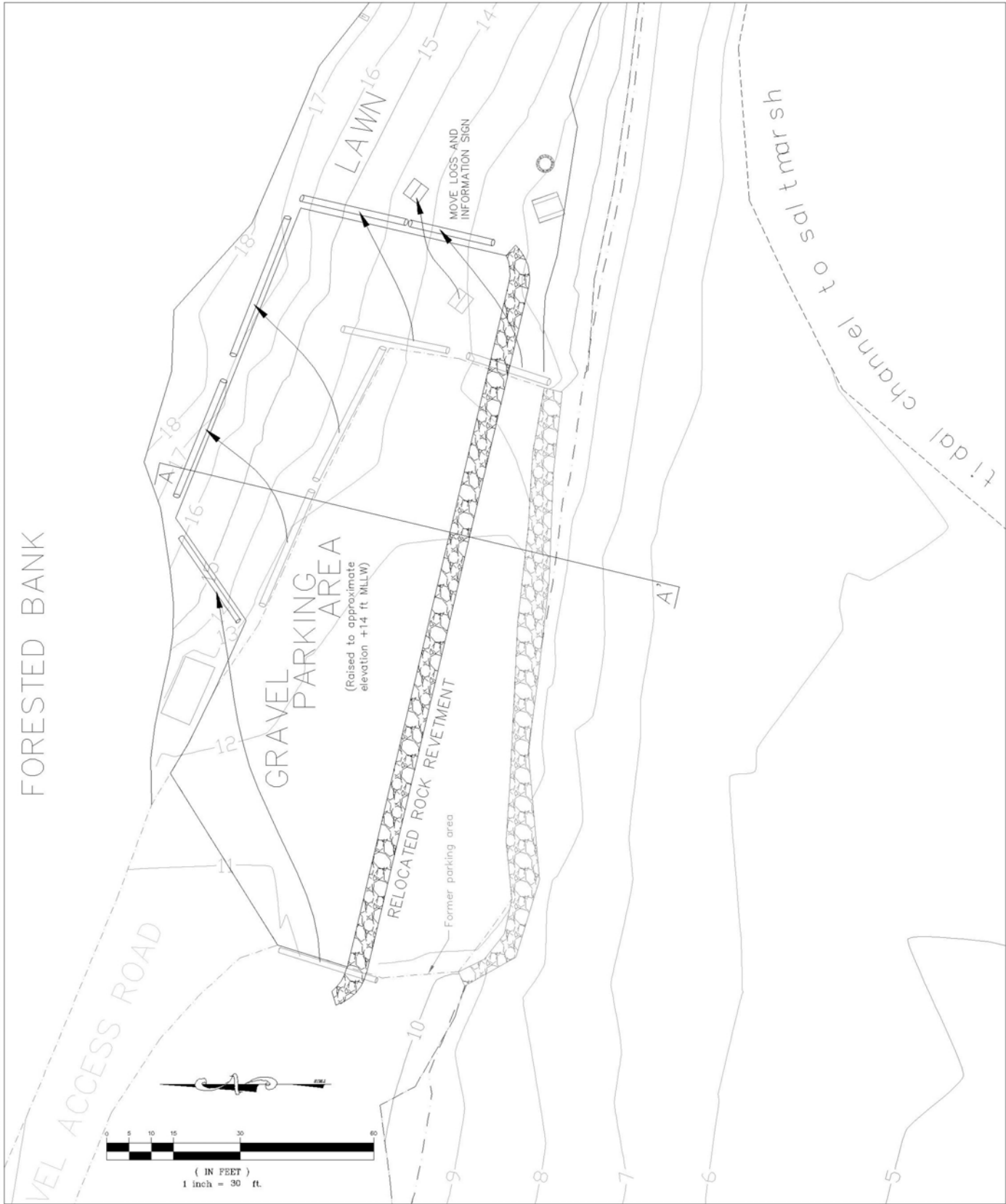


Figure 6. Oak Bay East proposed conditions

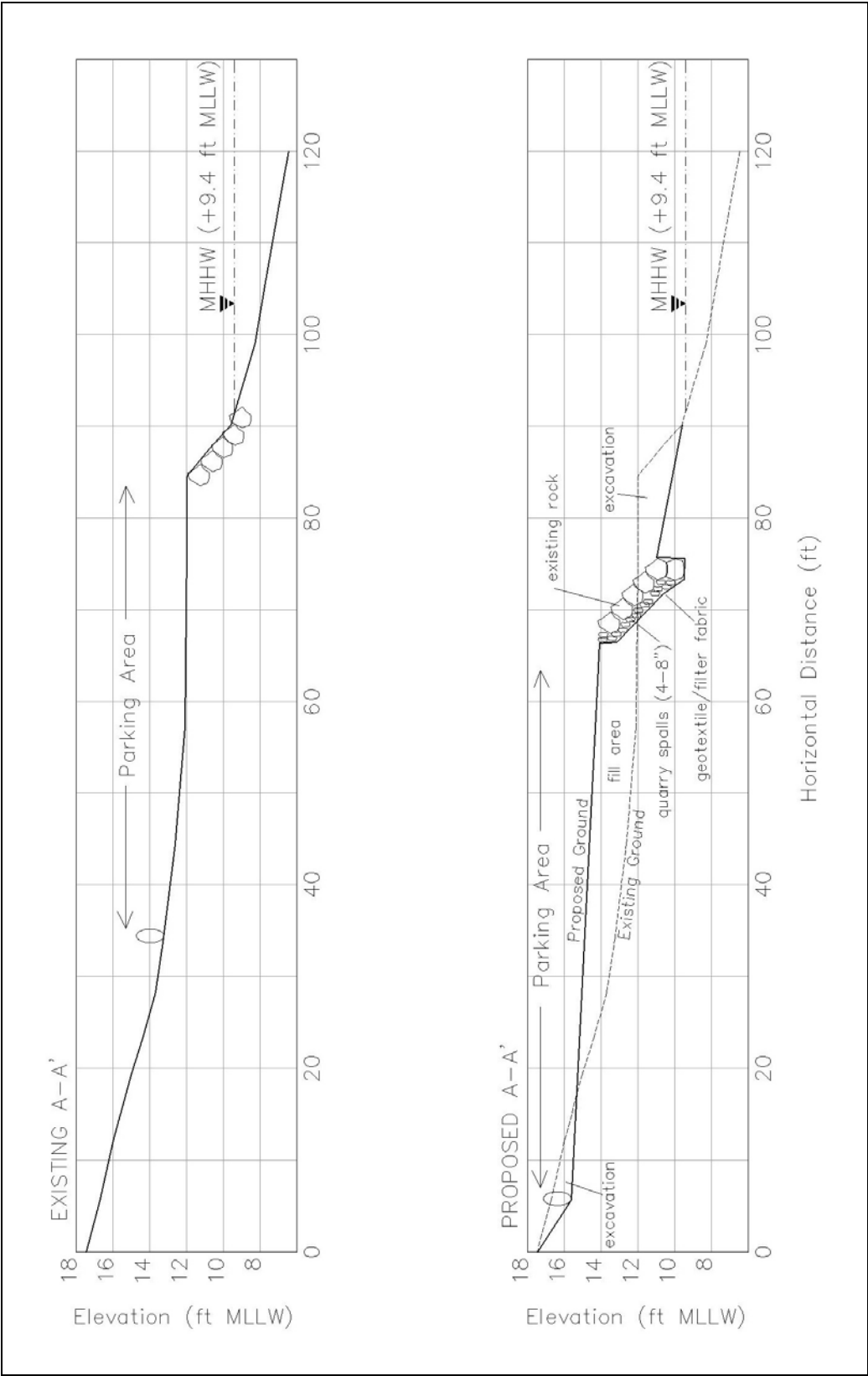


Figure 7. Oak Bay East cross sections

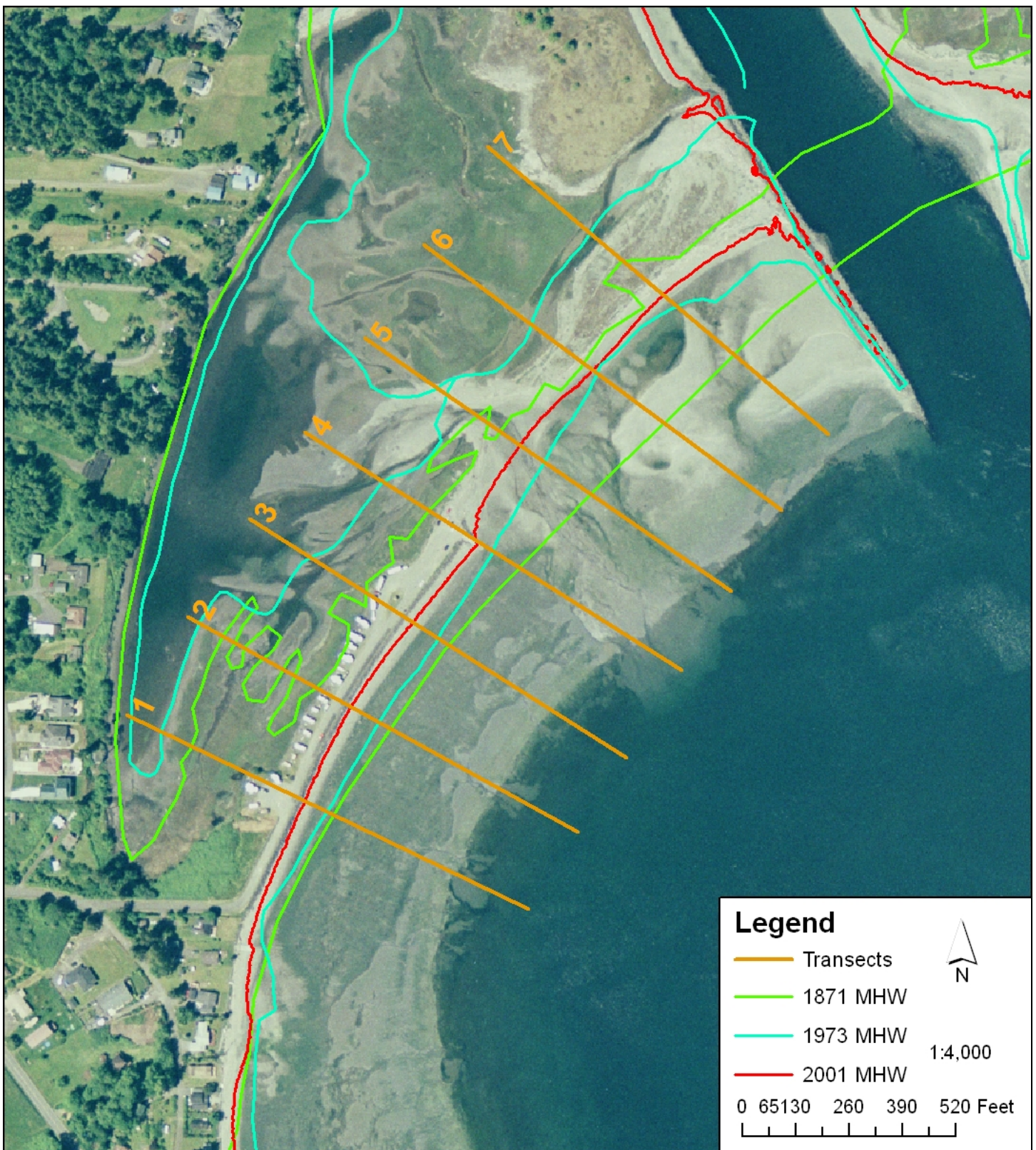


Figure 8. Oak Bay West historic shoreline change mapping



Figure 9. Oak Bay West oblique aerial photographs from 1977 (top), 1994 (middle), and 2001 (bottom).



Figure 10. Oak Bay West ground photos taken May 18, 2007.



Figure 11. Tarboo Bay oblique aerial photographs from 1977 (top), 1994 (middle), and 2001 (bottom).



Figure 12. Tarboo Bay ground photos taken May 18, 2007.

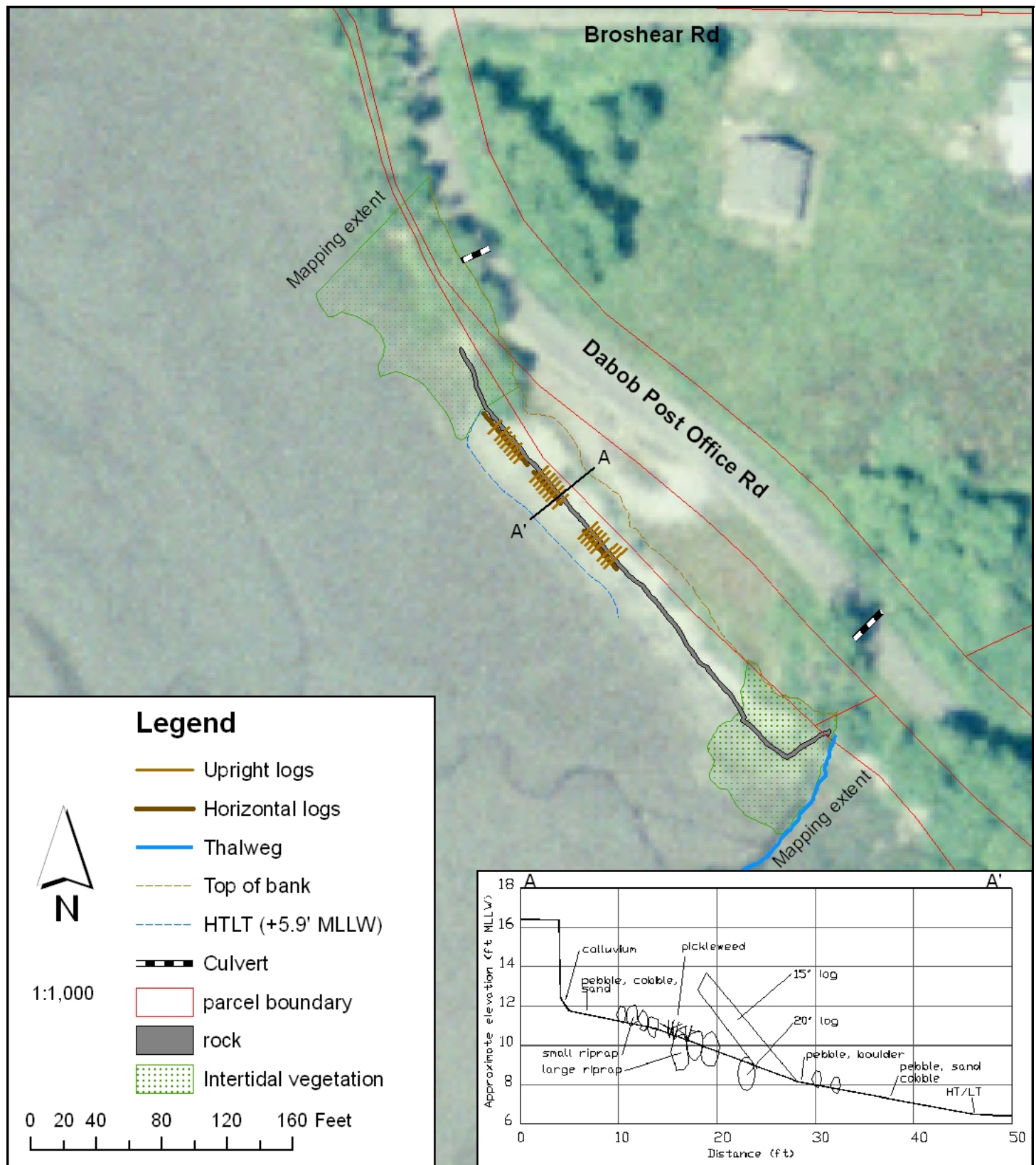


Figure 13. Tarboo Bay existing conditions



Figure 14. Fairmount Shore South (right) oblique aerial photographs from 1977 (top), 1994 (middle), and 2001 (bottom), and larger Fairmount marsh area.



Figure 15. Fairmount Shore South ground photos taken May 18, 2007, from east to west.



Figure 16. Fairmount Shore South existing conditions



Figure 17. Fairmount Marsh North ground photos taken May 18, 2007, culvert location, south shore, and wetland.